

What is claimed is:

- 1 1. A plasma processing apparatus comprising:
2 a plasma chamber in which a high-density plasma is
3 generated;
4 a sample chamber in communication with the plasma chamber
5 for housing a sample to be processed using the plasma; and
6 a protection tube for protecting an inner wall of the plasma
7 chamber from deposition of a product that results from the plasma
8 processing, wherein
9 the protection tube is composed of a plurality of pieces
10 formed in relation to a distribution of temperatures in the plasma
11 chamber at a time of the plasma processing.
- 1 2. The plasma processing apparatus according to Claim 1, wherein
2 the plasma chamber is tubular in shape,
3 the protection tube is tubular in shape and inserted in
4 the plasma chamber, and
5 each of the plurality of pieces is a tubular member disposed
6 in an axial direction of the protection tube.
- 1 3. The plasma processing apparatus according to Claim 2, wherein
2 each of the plurality of pieces is shorter in length than
3 a piece disposed at a location where a gradient of the temperatures
4 at the time of the plasma processing is smaller.
- 1 4. The plasma processing apparatus according to Claim 1, wherein

2 the protection tube is provided with at least one groove
3 formed on an inner wall thereof in parallel with an axis of the
4 protection tube.

1 5. The plasma processing apparatus according to Claim 1, wherein
2 the protection tube is provided with a plurality of grooves
3 formed on the inner wall thereof in parallel with an axis of
4 the protection tube at substantially equal circumferential
5 intervals.

1 6. The plasma processing apparatus according to Claim 1, wherein
2 the protection tube is made of quartz.

1 7. The plasma processing apparatus according to Claim 1, wherein
2 the sample is subjected to sputtering using the plasma.

1 8. The plasma processing apparatus according to Claim 1, wherein
2 the plasma is an electron cyclotron resonance plasma.

1 9. The plasma processing apparatus according to Claim 1, wherein
2 the plasma is an inductively coupled plasma.

1 10. The plasma processing apparatus according to Claim 1, wherein
2 the plasma is a helicon wave plasma.

1 11. A plasma processing apparatus comprising:
2 a plasma chamber in which a high-density plasma is

3 generated;

4 a sample chamber in communication with the plasma chamber
5 for housing a sample to be processed using the plasma; and
6 a protection tube for protecting an inner wall of the sample
7 chamber from deposition of a product that results from the plasma
8 processing, wherein

9 the protection tube is composed of a plurality of pieces
10 formed in relation to a distribution of temperatures in the sample
11 chamber at the time of the plasma processing.

1 12. The plasma processing apparatus according to Claim 11,
2 wherein

3 the sample chamber is tubular in shape,
4 the protection tube is tubular in shape and inserted in
5 the plasma chamber, and
6 each of the plurality of pieces is a tubular member disposed
7 in an axial direction of the protection tube.

1 13. The plasma processing apparatus according to Claim 12,
2 wherein

3 each of the plurality of pieces is shorter in length than
4 a piece disposed at a location where a gradient of the temperatures
5 at the time of the plasma processing is smaller.

1 14. The plasma processing apparatus according to Claim 11,
2 wherein

3 the protection tube is provided with at least one groove

4 formed on an inner wall thereof in parallel with an axis of the
5 protection tube.

1 15. The plasma processing apparatus according to Claim 14,
2 wherein

3 the protection tube is provided with a plurality of grooves
4 formed on the inner wall thereof in parallel with an axis of
5 the protection tube at substantially equal circumferential
6 intervals.

1 16. The plasma processing apparatus according to Claim 11,
2 wherein

3 the protection tube is made of quartz.

1 17. The plasma processing apparatus according to Claim 11,
2 wherein

3 the sample is subjected to etching using the plasma.

1 18. The plasma processing apparatus according to Claim 11,
2 wherein

3 the sample is subjected to chemical vapor deposition using
4 the plasma.

1 19. The plasma processing apparatus according to Claim 11,
2 wherein

3 the plasma is an electron cyclotron resonance plasma.

1 20. The plasma processing apparatus according to Claim 11,
2 wherein

3 the plasma is an inductively coupled plasma.

1 21. The plasma processing apparatus according to Claim 11,
2 wherein

3 the plasma is a helicon wave plasma.